

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
15 January 2004 (15.01.2004)

PCT

(10) International Publication Number  
**WO 2004/004993 A1**

(51) International Patent Classification<sup>7</sup>: **B26D 7/06, 7/32**

(74) Agent: **MODIANO, Guido**; Modiano & Associati, Via Meravigli, 16, I-20123 Milano (IT).

(21) International Application Number:

PCT/IB2003/003053

(22) International Filing Date: 30 June 2003 (30.06.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

BO2002A000422 2 July 2002 (02.07.2002) IT

(71) Applicant (for all designated States except US): **SACMI COOPERATIVA MECCANICI IMOLA S.C.R.L.** [IT/IT]; Via Provinciale Selice, 17/A, I-40026 Imola (IT).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

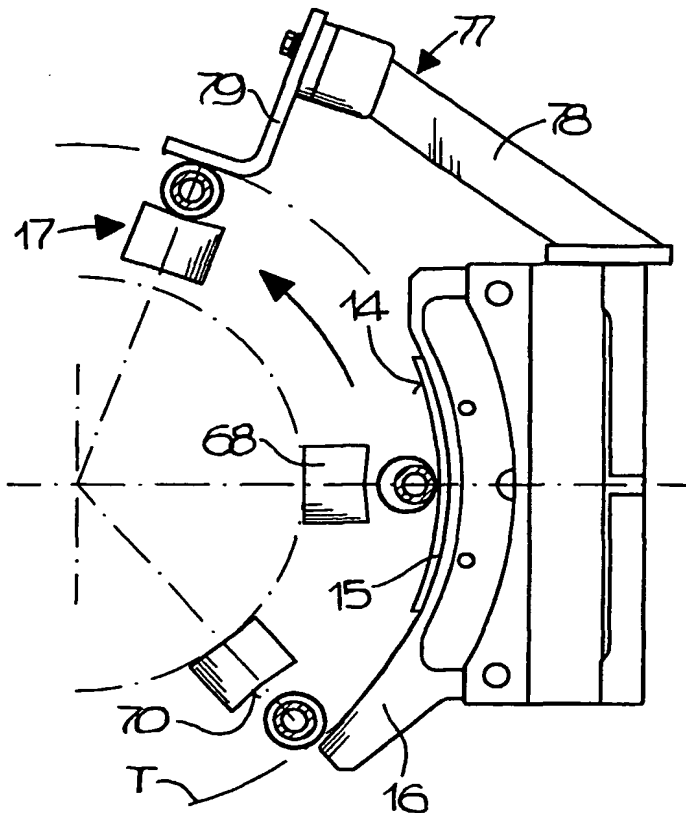
(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **ALBONETTI, Danilo** [IT/IT]; Via Giardino, 11/B, I-40020 Sasso Morelli (IT).

[Continued on next page]

(54) Title: APPARATUS FOR MAKING A FRACTURE CUT BETWEEN THE CUP AND THE SAFETY RING IN PLASTIC CAPS



(57) Abstract: An apparatus for making a fracture cut between the cup and the safety ring in plastic caps, which comprises rotary means (11) provided with at least one mandrel (12) that can be arranged inside the cup (3) and is suitable to produce the rolling, about its own axis of symmetry (S), of the side wall (13) of the cup (3) along the cutting edge (14) of a blade (15) for making the cut, the blade (15) being associated with an inlet path portion (16) adapted to axially offset the cup (3) with respect to the rotation axis (R) of the mandrel (12) by clamping the side wall (13) against the mandrel (12); the apparatus also comprises means (17) for recentering the cup (3) with respect to the rotation axis (R).

WO 2004/004993 A1



**Published:**

— with international search report

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## APPARATUS FOR MAKING A FRACTURE CUT BETWEEN THE CUP AND THE SAFETY RING IN PLASTIC CAPS

### Technical Field

The present invention relates to an apparatus for making a fracture cut  
5 between the cup and the safety ring in plastic caps.

### Background art

Apparatuses are known which produce, on the side wall of plastic caps, a  
circumferential fracture cut that forms the safety ring that remains attached  
to the container after tearing the cup from the cap: for this purpose, inside  
10 the cup there are retention elements, obtained for example by folding inward  
the end flap of the ring, which are suitable to engage on the protruding collar  
provided on the neck of the container.

In these apparatuses, the fracture cut is generally provided by rolling the  
lateral surface of the cap along a blade whose cutting edge is perpendicular  
15 to the axis of said cap by means of a mandrel that engages within the cup. In  
performing said cap rolling step, the mandrel is substantially axially offset  
with respect to the cup, since the blade is associated with an inlet portion  
that is suitable to move said cup with respect to the axis of the mandrel: in  
rolling the cap, the side wall of the cup is therefore kept pressed by the  
20 mandrel against the cutting edge of the blade, thus providing the cut.

At the end of the cap rolling step it is necessary to reposition the cup in  
axial alignment with respect to the mandrel, so as to be able to proceed  
correctly with the subsequent operations of the production process: for  
example, the cup must be removable from the mandrel without encountering  
25 the obstacle constituted by the undercuts formed by the presence of the  
retention elements within said cup.

Repositioning the cup, moreover, is a rather complicated operation in  
view of the many shapes and dimensions that characterize commercially  
available caps.

### Disclosure of the invention

The technical aim of the present invention is to provide an apparatus for making a fracture cut between the cup and the safety ring in plastic caps that allows, after forming said cut, to reposition the cup in axial alignment with respect to the mandrel inserted therein.

Within the scope of this technical aim, an object of the present invention is to provide an apparatus that is versatile and adaptable to caps of various shapes and dimensions.

Another object of the present invention is to achieve said aim with a structure that is simple, relatively easy to provide in practice, safe in use, effective in operation, and relatively low in cost.

This aim and these objects are all achieved by the present apparatus for making a fracture cut between the cup and the safety ring in plastic caps, which comprises rotary means provided with at least one mandrel that can be arranged inside said cup and is adapted to produce the rolling, about its own axis of symmetry, of the side wall of said cup along the cutting edge of a blade for making said cut, said blade being associated with an inlet path portion adapted to axially offset said cup with respect to the rotation axis of said mandrel by clamping said side wall against said mandrel, characterized in that it comprises means for recentering said cup with respect to said rotation axis.

Advantageously, said rotary means are driven by a motor by way of belt drive elements.

### Brief description of the drawings

Further particularities will become better apparent and evident from the detailed description of a preferred but not exclusive embodiment of an apparatus for making a fracture cut between the cup and the sealing ring in plastic caps according to the invention, illustrated by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a front view of the apparatus according to the invention;

Figure 2 is a partially sectional detailed front view of said apparatus;

Figure 3 is a detailed plan view of the apparatus in the step for forming the fracture cut;

Figure 4 is a partially sectional detailed side elevation view of the apparatus in the step for forming the fracture cut.

#### Ways of carrying out the invention

With particular reference to the cited figures, the reference numeral 1 generally designates an apparatus for making a fracture cut between the cup and the sealing ring in plastic caps 2 according to the invention.

The apparatus, of the type suitable to make a fracture cut between the cup 3 and the sealing ring 4 in caps 2 to be applied so as to close containers (the cup 3 being preferably provided with internal retention elements 5 for engagement on a collar provided on the respective container), comprises a footing 6, which protrudes upward with a substantially vertical frame 7 that is constituted by parallel uprights 8 that support a beam 9 (see Figure 1).

The footing 6 rotatably supports a rotary carousel 10, which has a vertical axis and is preset to convey continuously the caps 2 between input and output conveyance means, not shown in the figures. The footing 6 furthermore supports rotary means 11, which are provided with a plurality of mandrels 12 that have a vertical axis; each mandrel can be arranged inside a respective cup 3 and is suitable to roll, about its own axis of symmetry S, the side wall 13 of said cups 3 along the cutting edge 14 of a blade 15 for making the circumferential fracture cut on said side wall 13. For this purpose, the blade 15 is associated with an inlet path portion 16 for the cups 3, which is adjacent thereto and is suitable to axially offset each cup 3 with respect to the rotation axis R of the respective mandrel 12, so as to clamp the side wall 13 between said cutting edge 14 and the mandrel 12.

According to the invention, the apparatus comprises means 17 for recentering each cup 3 with respect to the rotation axis R of the respective mandrel 12 once the fracture cut has been made.

The carousel 10 is associated with means for continuous rotary actuation 18, which are constituted by a gearmotor 19 that is fixed by means of a flange 20 to parts 21 of the footing and has a vertical output shaft 22 that is rigidly connected so that it is coaxial to said carousel 10.

5 The carousel 10 comprises (Figure 2) a first drum 23, which is provided internally with an axial through cavity 24 and is connected in a downward region to a flanged shaft 25 that is connected to the output shaft 22 of the gearmotor 19 and is affected by multiple peripheral through holes 26 that have a vertical axis and are angularly equidistant for the sliding insertion of  
10 respective pillars 27 provided at their upper ends with seats for conveying the caps 2; the seats are preferably constituted by disk-like plates 28, which extend downward with respective stems 29 supported by thrust bearings 30 mounted within respective receptacles 31 provided in the pillars 27. The pillars 27 can be actuated so as to rise from a lower position to an upper  
15 position and have respective rollers 32 fixed to their respective lower ends, said rollers being engaged within an annular cam 33 that is coaxial to the extension 25 and monolithic with the footing 6. Multiple lateral through slots 33a are further provided on the first drum 23 and are mutually angularly equidistant.

20 The first drum 23 is surmounted by a second drum 34, which is rigidly coupled thereto, is substantially annular and is provided with a plurality of cylindrical through seats 35 that have a vertical axis, each seat being coaxial to a respective through hole 26 of the first drum 23: a respective cylindrical bush 36 is locked in each seat 35.

25 A support 37 is rigidly fixed to the second drum 34 and is constituted by multiple peripheral arms 38, which are extended vertically and are mutually angularly equidistant: each one of the arms 38 is affected by a respective slot 39, which corresponds to a respective seat 35 of the second drum 34.

A vertical column 40, rigidly coupled to the footing 6, is inserted  
30 coaxially through the first and second drums 23 and 34; a substantially disk-

like dome 41 is keyed to the top of the column 40 and is provided, in an upward region, with an opening 42 and has, on its lateral surface, a cylindrical cam 43 with a rolling track that has a rectangular transverse cross-section.

5 The rotary means 11 comprise a sliding block 44, which is provided with a lateral wheel 45 that engages in the cylindrical cam 43; the sliding block 44 is extended downward with a fixing bracket 46 for a rod 47, which is coupled elastically thereto with the interposition of a helical spring 48, which is inserted loosely in an elongated tubular body 49, which is  
10 supported so that it can rotate within the corresponding bush 36 and whose lower end ends with a substantially disk-like pad 50.

Each tubular body 49 has the respective mandrel 12 rigidly coupled thereto in a downward region; said mandrel is provided with an axial hole for the passage of the respective rod 47 and has, at its base, a cylindrical  
15 hollow 51 (Figure 4); the mandrel 12 is preferably provided, on its lateral surface, with a distribution of collars 52 for the abutment of the retention elements 5 of the cup.

Advantageously, the rotary means 11 are actuated by a motor 53, for example of the brushless type and provided with a vertical axis, by way of  
20 belt drive elements 54.

The belt drive elements 54 comprise a sleeve 55, which is supported so that it can rotate along the column 40 and is actuated by the motor 53 at the respective upper end 56; a first toothed pulley 58 and a second toothed pulley 59 are keyed to said sleeve at its respective lower end 57, and a first  
25 toothed belt 60 and a second toothed belt 61 are wound around said first and second pulleys respectively, said belts being closed in a loop and being suitable for the rotary actuation of the mandrels 12: the first and second belts 60, 61 are wound, with the aid of suitable tensioning rollers 62, around respective driven pulleys 63, which are keyed to the top of the respective  
30 tubular bodies 49.

A third toothed pulley 64 is keyed at the upper end 56 of the sleeve 55, and a third toothed belt 65 is wound around said third pulley; said third belt is closed in a loop and is suitable for connection to the motor 53; a driving pulley 67 is keyed on the output shaft 66 of the motor 53, and the third  
5 toothed belt 65 is wound thereon. The output shaft 66 passes through the opening 42 of the dome 41, and its axis is parallel to the axis of the sleeve 55; as an alternative, it is noted that the motor 53 can be connected coaxially directly to the sleeve 55.

The recentering means 17 comprise multiple pushers 68, each of which  
10 acts on the side wall 13 of the respective cup 3 in a direction that is substantially radial and centrifugal with respect to the axis of the carousel 10: the pushers 68 can be actuated by way of respective cam means 69.

Each one of the pushers 68 is preferably substantially quadrangular, with a slightly convex surface 70 for contact with the respective cup 3 (Figure 3);  
15 the pusher 68 is connected to an arm 71 that continues with a stem 72 that can slide, in a substantially radial direction with respect to the carousel 10, within a respective guiding block 73, which is inserted in a respective slot 33a. A wheel provided with a vertical axis 74 is supported so that it can rotate at right angles at the free end of each stem 72; the cam means 69 are  
20 constituted by a flat track 75, which is closed in a loop and is provided in the lower face of a bush 76 that is fixed coaxially to the carousel 10 along the column 40. The track 75 is suitable for the rolling of the wheels 74 having a vertical axis, causing the radial translational motion of the respective pushers 68 in order to move each cup 3 centrifugally, moving the axis of symmetry S  
25 of said cup 3 so that it coincides with the rotation axis R of the respective mandrel 13.

There is also a peripheral abutment element 77 for the cups 3 moved by the respective pushers 68, which comprises a supporting bracket 78 that has an elongated shape and ends with an L-shaped portion 79 that can be  
30 adjusted radially with respect to the carousel 10 according to the dimensions



of the cups 3.

The blade 15 is packed between a lower reference plate 80 and an upper complementary plate 81, which is locked thereat by virtue of suitable fixing means 82 (for example of the clamp type): the cutting edge 14 has a profile  
5 that is shaped substantially like a circular arc that is concentric with respect to the rotational path T of each cup 3 on the carousel 10. The inlet portion 16 is formed on the plate 80 and the complementary plate 81 and is shaped so as to provide an axial offset of the cup 3 in its rolling motion with respect to the rotation axis R of the respective mandrel 13.

10 The operation of the apparatus according to the invention is as follows: each cap 2 is locked on the carousel 10 between the plate 28 and the pad 50, said pad 50 being actuated so as to descend by virtue of the rolling of the respective lateral wheel 45 in the cylindrical cam 43, the plate 28 being actuated so as to rise to the plane of the blade 15 by virtue of the rolling of  
15 the respective roller 32 along the annular cam 33; the presence of the helical spring 48 allows to compensate for even slight size differences among the various caps arising from any manufacturing imperfections.

The rolling of each cup 3 about its own axis of symmetry S, which is substantially parallel to the rotation axis R of the respective mandrel 12 after  
20 passing over the inlet portion 16, allows to make the fracture cut along the side wall 13, which is clamped between said mandrel 12 and the blade 15 (see Figure 4).

At this point, the cam means 69 induce the centrifugal radial translational motion of the corresponding stem 72 and therefore of the pusher 68, which  
25 by acting on the side wall 13 of the cup 3 makes its axis of symmetry S coincide again with the rotation axis R of the respective mandrel 12; this occurs with the aid of the abutment element 77, which stops precisely the radial movement of the cup 3 (Figure 3).

The apparatus according to the invention ensures, at the end of the  
30 provision of the fracture cut, an effective recentering of the cup 3 with

respect to the rotation axis R of the mandrel 12; this operation, moreover, can be performed in a very versatile manner with caps 2 of various shapes and dimensions.

5 It has thus been shown that the invention achieves the proposed aim and objects.

The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

All the details may further be replaced with other technically equivalent ones.

10 In practice, the materials used, as well as the shapes and the dimensions, may be any according to requirements without thereby abandoning the scope of the protection of the appended claims

The disclosures in Italian Patent Application no. BO2002A000422, from which this application claims priority, are incorporated herein by reference.

CLAIMS

1. An apparatus for making a fracture cut between the cup and the safety ring in plastic caps, comprising rotary means (11) provided with at least one mandrel (12) that can be arranged inside said cup (3) and is adapted to  
5 produce the rolling, about its own axis of symmetry (S), of the side wall (13) of said cup (3) along the cutting edge (14) of a blade (15) for making said cut, said blade (15) being associated with an inlet path portion (16) adapted to axially offset said cup (3) with respect to the rotation axis (R) of said mandrel (12) by clamping said side wall (13) against said mandrel (12),  
10 characterized in that it comprises means (17) for recentering said cup (3) with respect to said rotation axis (R).

2. The apparatus according to claim 1, characterized in that it comprises a carousel (10) that has a vertical axis and is provided with multiple peripheral  
15 seats (28) for conveying said cups (3) between input and output conveyance means, and a footing (6) that extends upward with a frame (7) that surmounts said carousel (10), said rotary means (11) being actuated by a respective motor (53) by way of belt drive elements (54).

3. The apparatus according to claims 1 and 2, characterized in that said recentering means (17) comprise multiple pushers (68), which act on said  
20 side wall (13) of each one of said cups (3) in a direction that is substantially radial and centrifugal with respect to said carousel (10), and are actuated by respective cam means (69).

4. The apparatus according to one or more of the preceding claims, characterized in that each one of said pushers (68) has a substantially  
25 quadrangular shape, in which the surface (70) for contact with said cups (3) is convex, said pusher (68) being connected to an arm (71) that extends with a stem (72) that can slide substantially radially with respect to said carousel (10) within a respective guiding block (73), said stem (72) being connected at its free end to a respective wheel (74), said cam means (69) comprising a  
30 track (75) that is closed in a loop and is provided on a bush (76) that is

coaxial to said carousel (10) and is monolithic with said footing (6), said track being suitable for the rolling of said wheel (74) and having such a shape as to produce the radial translational motion of said pusher (68).

5        5. The apparatus according to one or more of the preceding claims, characterized in that said belt drive elements (54) comprise a sleeve (5), which is supported so that it can rotate on a column (40) that is coaxial to said carousel (10), is rigidly coupled to said footing (6), is actuated at the respective upper end (56) by said motor (53), and on which first and second coaxial toothed pulleys (58, 59) are keyed at the respective lower end (57),  
10       first and second toothed belts (60, 61) being wound respectively around said pulleys, said belts being closed in a loop and being suitable for the rotary actuation of a plurality of said mandrels (12) that have a vertical axis.

      6. The apparatus according to one or more of the preceding claims, characterized in that said motor (53) is coaxially connected to said upper end  
15       (56) of said sleeve (55).

      7. The apparatus according to one or more of the preceding claims, characterized in that a third toothed pulley (64) is keyed at said upper end (56) of said sleeve (55), a respective third toothed belt (65) being wound around said third pulley, said third belt being closed in a loop and suitable  
20       for connection to said motor (53), whose axis is parallel to the axis of said sleeve (55).

      8. The apparatus according to one or more of the preceding claims, characterized in that said cutting edge (14) of said blade (15) has a profile that is substantially shaped like a circular arc that is concentric with respect  
25       to the path (T) of the rotation of said cups (3) conveyed by said carousel (10), said inlet portion (16) being formed by a plate (80) and a complementary plate (81) for supporting said blade (15).

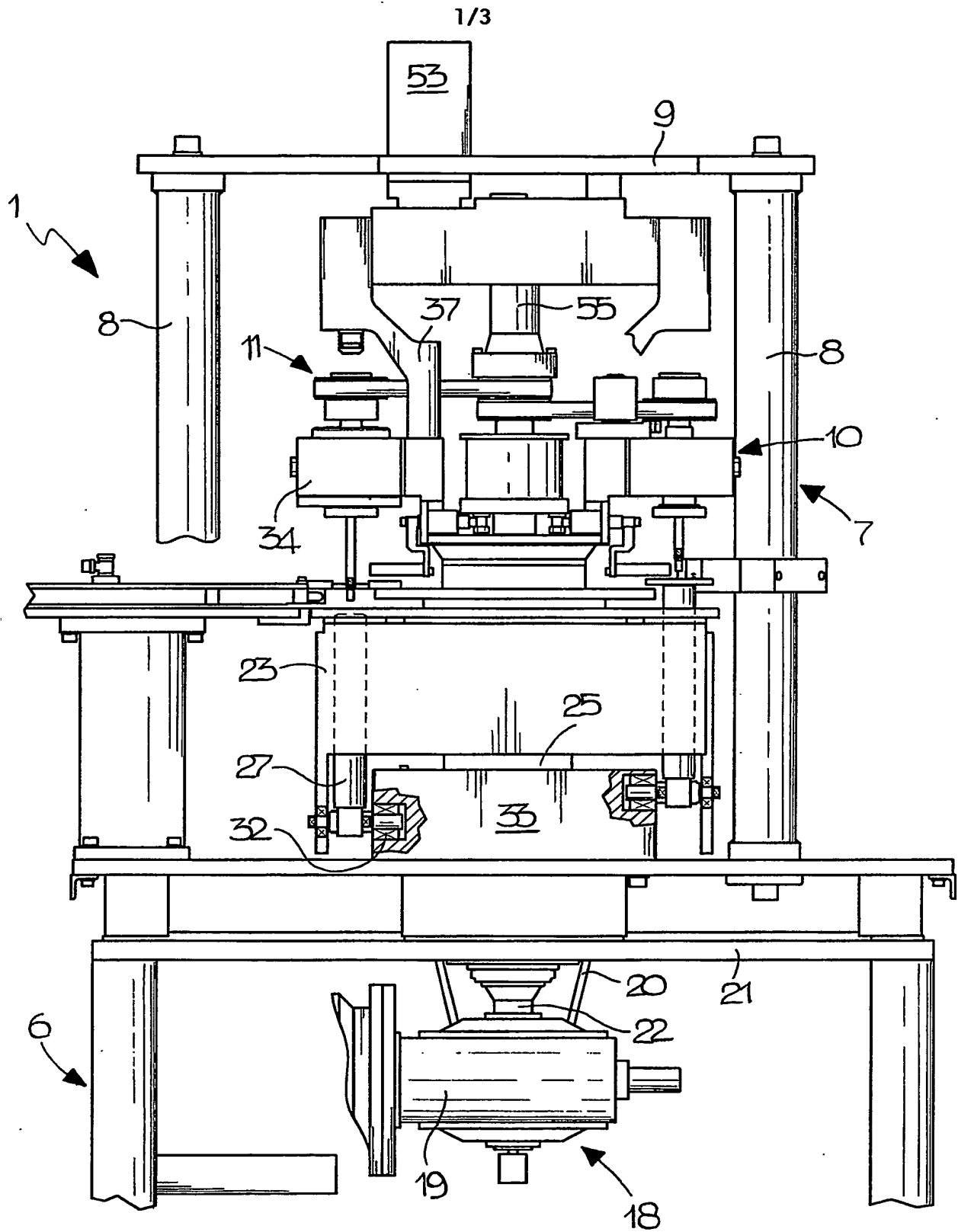


FIG 1

2/3

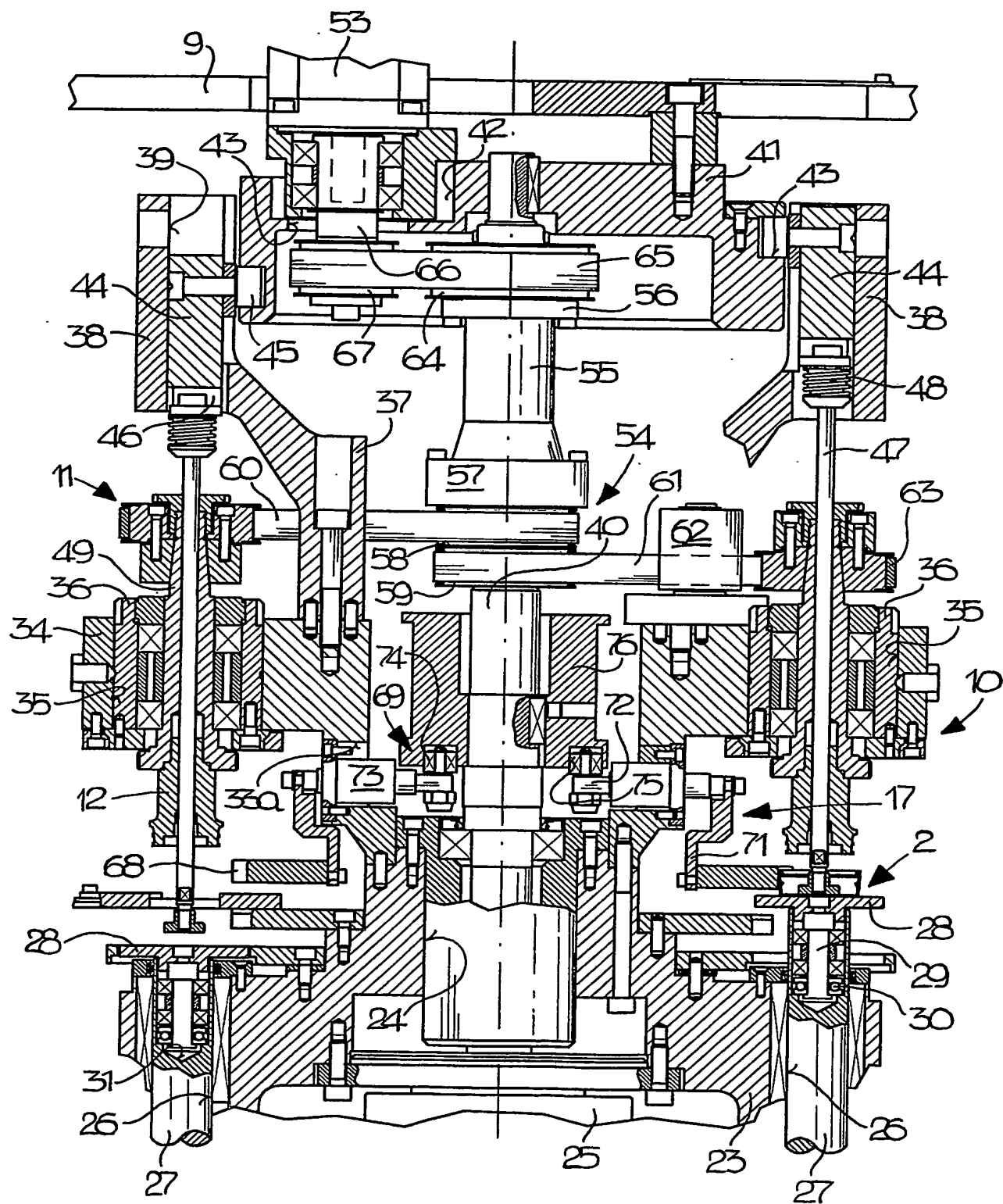


FIG 2

3/3

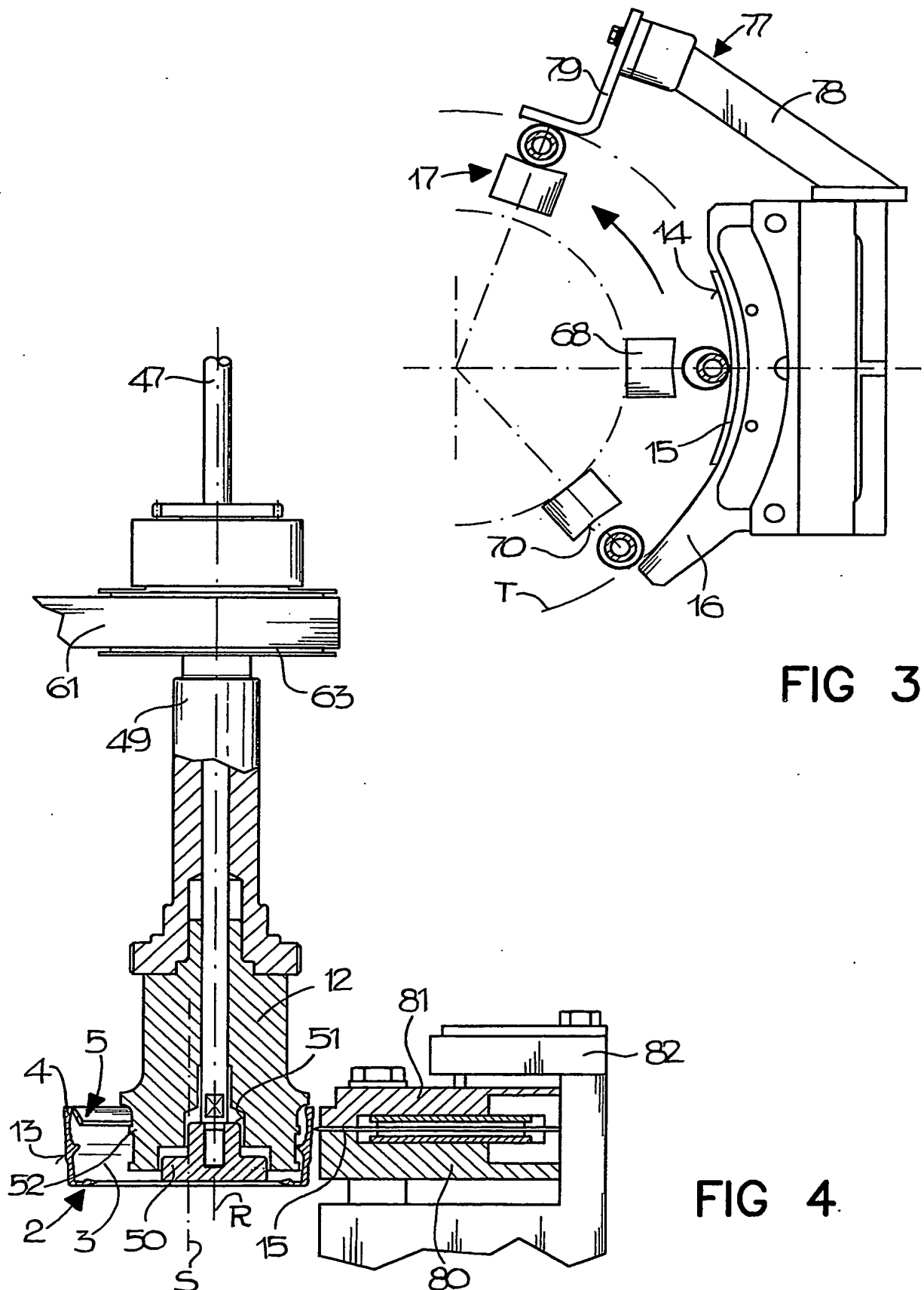


FIG 3

FIG 4

## INTERNATIONAL SEARCH REPORT

Internat application No

PCT/JP 03/03053

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 7 B26D7/06 B26D7/32

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B26D B26F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	EP 1 243 520 A (OBERBURG ENGINEERING AG) 25 September 2002 (2002-09-25) column 4, line 1840 column 5, line 23 - line 25 column 6, line 48 - line 55 column 7, line 19 - line 26; figures ---	1,4,8
X	US 4 744 480 A (LUCH DANIEL ET AL) 17 May 1988 (1988-05-17) column 9, line 47 - line 58; figures 6-8 ---	1,8
A	EP 0 533 633 A (ITALCAPS SPA) 24 March 1993 (1993-03-24) column 4, line 21 - line 24; figures --- -/--	8

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*G\* document member of the same patent family

Date of the actual completion of the international search

20 October 2003

Date of mailing of the international search report

27/10/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
 Fax: (+31-70) 340-3016

Authorized officer

Vaglianti, G



## INTERNATIONAL SEARCH REPORT

Internat Application No

PCT/T 3/03053

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 96 11856 A (CARNAUDMETALBOX SA ;METAL BOX PLC (GB); CARNAUDMETALBOX NV (NL); H) 25 April 1996 (1996-04-25) page 10, line 19 - line 22 page 11, line 19 - line 24 -----	8

## INTERNATIONAL SEARCH REPORT

Internal application No

PCT/TS 03/03053

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 1243520	A	25-09-2002	EP 1243520 A1	25-09-2002
US 4744480	A	17-05-1988	CA 1281001 C	05-03-1991
			DE 3674903 D1	15-11-1990
			EP 0228618 A2	15-07-1987
			US 4904435 A	27-02-1990
			US 4895265 A	23-01-1990
EP 0533633	A	24-03-1993	IT 1250101 B	30-03-1995
			AT 144738 T	15-11-1996
			DE 69214907 D1	05-12-1996
			DE 69214907 T2	15-05-1997
			DK 533633 T3	24-03-1997
			EP 0533633 A2	24-03-1993
			ES 2095449 T3	16-02-1997
			GR 3022352 T3	30-04-1997
			ZA 9206999 A	10-05-1993
WO 9611856	A	25-04-1996	AT 187945 T	15-01-2000
			AU 3614495 A	06-05-1996
			CA 2202492 A1	25-04-1996
			CN 1160385 A ,B	24-09-1997
			DE 69514114 D1	27-01-2000
			DE 69514114 T2	20-04-2000
			EP 0784575 A1	23-07-1997
			ES 2139940 T3	16-02-2000
			WO 9611856 A1	25-04-1996
			US 5809860 A	22-09-1998
			ZA 9508573 A	13-05-1996